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Date: _____

By: _____
Jennifer Archer

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT : Klaus KULPER et al.
SERIAL NO. : 10/590,109
CUSTOMER NO. : 27384
FILED : April 12, 2007
FOR : HIGHLY ABRASION-RESISTANT TAPE FOR BINDING CABLE
TREES IN MOTOR VEHICLES
ART UNIT : 1794
EXAMINER : Ronak C. Patel

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 CFR § 1.132

SIR:

I, Dr. Klaus Kuelper hereby declare:

1. I am an inventor of the subject matter disclosed and claimed in the above-identified application (hereinafter "the present application").
2. In 1981, I received the Diploma degree in Chemistry from University of Hamburg,, Germany.
3. Since 1985, I have been employed by tesa SE (formerly tesa AG) as Chemist in

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R&D, responsible for the development of adhesive tapes.

4. I have been involved in an effort to solve a problem encountered in adhesive tapes used in particular for bandaging cable harnesses in automobiles.

5. In many segments of industry, electrical lines are bundled together by means of bandaging with adhesive tapes before installation or after mounting in order to reduce the space taken up by the bundle of lines and also to protect the lines from damage.

6. The protective function is drawing increasing attention in the art, particularly the resistance of the adhesive tape to abrasion by, for example, scuffing, rubbing, grinding on sharp edges and burrs, etc. The sharp edges, burrs and weld points, etc., that come about as a result of production operations are increasingly not having their sharpness removed by complicated post-production work, since such work entails an additional operation and increased costs. This is especially true in the case of the untreated bodies in the automobile industry, but also in other segments too, such as in the case of washing machines, vibrating machines such as compressors and the like, for example. Cable strands that run in such segments and are scuffed by vibration, relative movements and the like on such sharp points are, therefore, at potential risk of destruction of the protective sheath. This protective sheath may be the additional wound bandaging, or else may be the insulation around the copper cable itself. In that case, the result would be a short circuit with complete functional failure and destruction of electrical/electronic components, possibly going as far as a fire, with the attendant risks of damage to equipment and people.

7. Surprisingly, we discovered that the protective function against abrasion

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resistance could be maximized if, in one embodiment, the adhesive tape were constructed as a backing having a first outer layer A and a second outer layer B, with an interlayer C located between and firmly connected, in each case over its entire surface, to the outer layers A and B, if the outer layers A and B were composed of a woven or formed-loop knit, if the interlayer C was composed of a viscoelastic adhesive, self-adhesive, or a double-sided adhesive tape, and if the interlayer C has a basis weight of 40 to 600 g/m².

8. Especially, the criticality in this embodiment of the interlayer C having a basis weight of 40 to 600 g/m² is borne out by the data in the instant specification beginning on page 13.

9. As outer layers, suitable are all sheetlike structures that offer a suitable scuff resistance and surface area as to be appropriate for applications of this kind in the automobile segment, especially woven fabrics, formed-loop knitted fabrics, velours, nonwovens and similar textile materials. Fabrics which have proven particularly suitable are closely woven filament fabrics of polyester or nylon, or else of glass fibers or high-performance plastics such as carbon fibers, with a weave construction of 40 to 50 threads per cm in the warp direction and 20 to 30 threads per cm in the fill direction. Woven PET fabrics of this kind with a basis weight of from 70 to 150 g/m² have already been used for some time in wrapping tapes in the engine compartment, are temperature-resistant and age-resistant and are known to have a mean abrasion resistance of approximately 300 to 1000 scrape cycles in accordance with ISO 6722 (mandrel diameter 10 mm, 10 N applied weight, 0.45 mm steel wire) (see Table 1):

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Adhesive tape	Abrasion resistance	
Woven PET fabric (130 g/m ²) with rubber compound	500	to 1000 cycles
Stitchbonded PET web (80 g/m ²) with rubber compound	20	to 100 cycles
0.1 µm PVC film with rubber compound	1	to 50 cycles
TwistTube = braided PET hose (without adhesive)	2000	to 5000 cycles

Table 1

10. If it is assumed in a first approximation that the abrasion resistance is doubled when a woven filament fabric of this kind is used in a double ply with from 5 to 30 g/m² of a (partially applied) laminating adhesive in-between, then the effect when using an interply of 50 g/m² or more of a suitable viscoelastic adhesive layer - a UV-crosslinked hotmelt acrylate adhesive or a natural rubber adhesive, for example - is surprisingly positive.

The abrasion resistance of a composite system of this kind is significantly higher than the sum of the outer plies (Table 2).

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Construction of the backing assembly from 2 woven PET filament fabrics (125 g/m ²) and as interlayer C		Abrasion resistance (7 N applied weight)
A	none	5130 cycles
B	30 g/m ² laminating adhesive	5310 cycles
C	120 g/m ² acrylate hotmelt adhesive	12 000 cycles
D	260 g/m ² natural rubber adhesive	> 20 000 cycles

Table 2

11. For the measurement of version A, two plies of the above-described woven PET filament fabric are fixed mechanically on the abrasion measurement apparatus and measured without an additional laminating adhesive. The use of the laminating adhesive in the case of version B produces no significant increase in abrasion resistance as compared with the adhesive-free base version A.

12. Only when an interlayer of the invention is employed - in this example 120 g/m² of a UV-crosslinked acrylate adhesive - is there an increase in the abrasion levels by more than 100%. A construction of this kind as version C can be realized industrially without great effort by laminating together two single-sided woven tapes each constructed from a woven PET backing with an adhesive coat weight of 60 g/m². The result is the inventive backing assembly composed of the two woven outer layers and $2 \times 60 \text{ g/m}^2 = 120 \text{ g/m}^2$ of adhesive as an interlayer in-between. The woven PET tape coated on one side with 60 g/m² of acrylate adhesive has an abrasion resistance of 1800 cycles, and so for the backing assembly according to version C the

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corresponding abrasion value that could have been expected was 3600 cycles. In actual fact, however, it is possible to increase the abrasion resistance by more than 300%.

13. In version D, the interlayer used is a commercially available double-sided carpet-laying tape (tesafix ® 4964) consisting of about 250 g/m² of a resin-modified natural rubber adhesive and a 110 g/m² woven spun rayon fabric as central backing material. When subjected to abrasion measurement, the double-sided adhesive tape gives a value of only about 500 cycles; in its function as an interlayer for the two woven PET outer layers, the abrasion measurement on version D was discontinued after 20 000 cycles without the backing assembly having been abraded right through. In this combination, as well, the scuff resistance is improved by more than 300% in comparison with the sum of the individual values.

14. The absolute gain in abrasion resistance is even greater if a suitable further backing is additionally installed between the two woven PET fabric outer plies. These may be films, foamed films, foams and in particular textile backings. With version C from table 2 as the basis, it is possible to produce further highly abrasion-resistant backing assemblies if a textile backing is inserted centrally into the interlayer of 120 g/m² self-adhesive composition.

15. In technical terms, this variant can also be realized in an extremely simple way by laminating the textile backing in question between two plies of the above-described woven PET tape with 60 g/m² self-adhesive composition (Table 3). Since the two outer layers are already coated with sufficient self-adhesive composition, there is no need for separate fixing of the textile ply. The self-adhesive composition therefore fulfills the dual function of being an abrasion-promoting interlayer and of being a fixing aid for the centrally introduced textile.

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Construction of the backing assembly from 2 outer plies of a woven PET fabric (125 g/m ²) and 60 g/m ² acrylate adhesive and a textile backing		Abrasion resistances	
		7 N	10 N
		Applied weight	
3	none	12 000 cycles	5100 cycles
5	PET staple fiber web, 60 g/m ²	> 20 000 cycles	-----
6	Woven filament fabric, 60 g/m ²	> 20 000 cycles	-----
7	Nylon fabric, 75 g/m ²	34 400 cycles	
8	PET loop fabric, 230 g/m ²	> 50 000 cycles	
9	PET Multiknit, 320 g/m ²	-----	> 23 000 cycles

Table 3

16. Even nonwovens that lack inherent abrasion resistance, such as, for example, a hydroentangled PET staple fiber web of 60 g/m² basis weight, which on its own is abraded right through after just 140 cycles, improves the abrasion resistance of the overall assembly according to version 5 from 12 000 to more than 20 000 cycles. When inherently stable textile backings are used centrally in the backing assembly (variants 7 to 9 with a loop fabric, a nylon fabric and a Multiknit nonwoven, respectively), the abrasion measurement with an applied weight of 7 N is already reaching its limits. An increase in the scuffing load by 10 N applied weight produces more than 23 000 cycles even for variant 9, however. This puts assemblies of this kind in the regions that are measured for special abrasion protection components on cable looms, such as

braided hoses, fluted tubes, etc., and that offer maximum protection. In particular, textiles made from toughened elastic or wear-resistant materials, such as polyamide, carbon fibers or glass, for example, lead to further improvements in abrasion protection.

17. From the exemplary backing assemblies of Tables 2 and 3, it is clear that, with a corresponding construction of the backing material in accordance with the invention, very high abrasion and scuff resistances are achievable, so that adhesive tapes produced from such backings offer an attractive combination of bandaging and wrapping tape with integrated abrasion protection.

18. Indeed, as indicated in the last paragraph of the instant specification, if the woven PET filament fabrics described in Instant Example 1 are used as outer layers but only a minimal amount of a heat-activable, thermoplastic laminating adhesive is used to form the assembly, the abrasion values which result from the overall assembly correspond virtually only to the sum of the two outer layers (version 2 from table 2). Additional protection is therefore not achieved, as is the case for the inventive examples.

19. In my opinion, the finding that the basis weight of the interlayer C affects the abrasion resistance of the outer layers is completely surprising and unexpected.

20. In my opinion, based on my education and experience in the field, these data at from 60-320 g/m² reasonably support the surprising and unexpected improvement over the entire claimed range of the interlayer C having a basis weight of 40 to 600 g/m².

21. I am informed that the Examiner questions the inventiveness/obviousness of the present invention over our own prior application published as US 2003/0198806 (hereinafter

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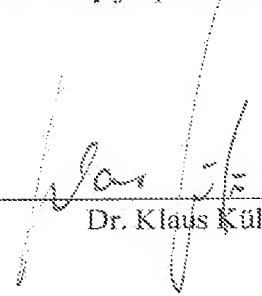
“Samson-Himmelstjerna”).

22. In my opinion, there is nothing in Samson-Himmelstjerna establishing the basis weight of interlayer C as a result-effective variable affecting abrasion and scuff resistance, yet this surprising and unexpected result is demonstrated unequivocally by the data in the instant specification. As a colleague of Samson-Himmelstjerna at the relevant period of time very close also to him and his invention I have known his invention pretty well focusing only on an improved tape design for easy wrapping along a long wire harness -- increased weight of the interlayer C would have obviously caused higher production costs and was therefore not taken in consideration and no part of the investigation.

23. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and that the foregoing statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Dated: November 24th, 2010

By: _____


Dr. Klaus Külper